Perceptive Presence in Intelligent Environments

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The Problem: Increasingly, more and more people are living and working separated from their family and co-workers. As telecommuting starts to become the norm, and families separate across the country and the world, systems that bring people together in a spontaneous way will be needed. We envision these systems to co-exist with people in their current spaces. These devices work to convey presence about family members and co-workers and initiate conversation without being intrusive or interrupting.

Motivation: The majority of our communication at work and at home takes place spontaneously. It is unplanned and usually occurs when two people just happen to be co-located. As people become physically separated, communication will decrease as shown in [1]. However, people still have a need to communicate, and unplanned conversations serve an important role in getting business done or maintaining relationships with family and friends.

Therefore, we see a need for people to have devices that simulate co-presence. These devices should be non-interrupting, simulating people who wait for opportune moments to start spontaneous conversations. We also feel that for ease of use and interaction, these devices should be familiar objects integrated into one's life (i.e. the lamp in Figure 1). We believe that this brings about a greater sense of presence as it is removed from the unfriendly world of the computer keyboard.

Figure 1: The two upper images show the level of physical presence when both users are in their office but not explicitly looking at the lamp (which is dim). In the lower images, one of the users has noticed his lamp getting brighter and has returned the gaze of his coworker, brightening his lamp as well.

Previous Work: Over the past ten years, much work has been produced in the separate areas of Computer Supported Co-operative Work (CSCW) and in Intelligent Environments (IEs). Much of this work has been independent and most IE projects have been limited to a single location with limited communication capabilities with other environments. Most CSCW communication projects have been used primarily for limited text or audio/video communication among members of a team and have not been linked with other awareness information gathering tools. Other researchers are focusing on more artistic and abstract representations of presence using light and sound instead of textual or video information.

Xerox EuroPARC has been a leader in developing communication systems for workers. RAVE, an environment for communicating with video and audio among workers at EuroPARC provided a mechanism for communicating from one's office. The system allowed users to "peek in" on a particular office providing a view similar to walking past an open door in the hallway. In this system, "peeking in" on someone was the only way to determine if they were available. It was not tied to a larger awareness system that offered passive information. [4]

Individuals such as Bill Gaver of the Royal College of Art and Konrad Tollmar of the MIT AI Lab have worked on

several projects that represent presence and awareness information in a more abstract manner. Tollmar's prototypes such as "The Frame" and "6th Sense" [5] represent awareness of remote activity by using pictures and light to display information away from the setting of a computer monitor.

Gaver's prototypes and sketches show that there is no limit in the imagination when creating possible communication or display devices. [3] Gaver seems to incorporate artistic beauty and functionality in his sketches while designing useful systems that promote individual or societal awareness. Designs that move the user away from the traditional keyboard and screen could help make an awareness application more acceptable and less intruding on a person's daily routine.

Approach: To study this emerging area, we are conducting a series of user studies with iterative prototyping. A preliminary study was completed in January 2002 to determine how communication occurs in the AI lab. This study identified several major issues. First, it collaborated earlier studies in showing that a majority of all communication in the lab was spontaneous, not explicitly sought out by those involved in the conversation. This supports the use of a presence system to create a similar effect of running into a person in the hallway or common area. A second finding was that people often do not know when others are at work or available. A presence system would help in this regard as well as it could notify others when a person is present.

With the goals of creating a system to enhance spontaneous conversations over a distance and inform others about a person's availability, we created the perceptive presence lamp as depicted in Figure 1. [2] This lamp can convey four levels of presence between two parties. The first level is "no presence." If a user is not present, the lamp in the peer's office will be off. The second level is "presence," which is measured by an IR motion detector and represented by a dim light in the peer's lamp. The third level is the "attention getting" level and is measured by using frontal face detection to determine when a user is staring at the lamp for 3 seconds. This action is conveyed by either a bright glow or a change in color depending on the type of lamp a user has. If both users enter this "attention getting" mode simultaneously, an audio link can be opened to initiate a conversation between the parties in the "communicating" level. It is intended that this lamp creates a sense of connectedness among users and simulates the natural gesture of looking at someone in order to talk to them.

Initial studies were conducted in the spring to verify the concept and test between several prototypes, including a dimmable lamp and a color changing lamp. Participants in this study were able to interact with the lamp and generally found "getting the lamp's attention" by looking at it to be a natural interaction.

Impact: So far this project has made several contributions. First, it identified four levels of presence ("not present," "present," "attention getting," and communicating"). These levels are important for defining the functions and interactions of a presence system. We feel that these four levels cover the most likely and most useful levels of presence a user would convey.

Secondly, this project has integrated a real-time face detector with a physical perceptive presence device. This allows for natural interactions on the part of the user and moves the interaction away from a computer and towards a physical artifact.

Finally, this work is a living project, based in user studies and evolving over time. This project has created a tool useful for people in an office and personal setting to use to communicate with each other.

Future Work: Throughout the fall semester, we plan to continue to test this prototype with users and make improvements as necessary. We would like to explore expanding the concept of the lamp to include groups of people, not just a two person interaction. This will include more user studies and prototyping.

References:

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